

# Ingredients in Flea & Tick Control Products

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Perhaps no area of veterinary medicine has grown as rapidly as the field of flea and tick control. Fleas have seemed to explode in numbers and there are huge efforts aimed at controlling them. Ticks can transmit a number of diseases, so tick control is also receiving more attention. Today's insecticides for pets have made great advancements and a wide array of different compounds have been formulated. The goal of this article is to explain some of the common, active ingredients listed on the labels of various flea and tick control shampoos, dips, sprays, powders, foggers, etc. We have included a table at the end of the article to help summarize the information on those flea and tick control products used on dogs and cats. **Note:** For completeness, information on ingredients that should not be used in cats but are found in products for dogs (e.g., permethrin and amitraz) are included in this article.

## Pyrethrins

Pyrethrins are one of the most widely used insecticides in today's flea and tick products and have been used as insecticides for over 100 years. Pyrethrins are natural extracts made from flowers of chrysanthemum plants. These plants grow naturally in the Middle East, Europe, Japan, and most importantly, Kenya. There are six different pyrethrins: pyrethrin I and II, cinevin I and II, and jasmolin I and II. All six are found in flea and tick products, but generally, the label only reads 'Pyrethrin,' regardless of which of the six types is actually present.

**Mode of Action:** Pyrethrins affect the nervous system of insects and result in repeated and extended firings of the nerves. They do this by affecting the flow of sodium out of nerve cells.

**Use:** Pyrethrins are used to control ticks, fleas, lice, *Cheyletiella* mites, and mosquitoes. They are mainly found in products applied directly on the pet. Household products generally contain either pyrethrins, a combination of pyrethrin and permethrin (see below), or pyrethrins plus a synergist. Synergists are chemicals that enhance the performance of other drugs. The synergist most widely used with pyrethrins is piperonyl butoxide.

**Safety:** All pyrethrins are easily hydrolyzed and degraded by stomach acids, so toxicity following ingestion by pets is very low. Toxicities, although rare, do occur. A cat or dog with pyrethrin toxicosis generally will salivate, tremor, vomit, and may seizure. Generally, signs of toxicosis will be gone after 24 hours.

## Pyrethroids (e.g.; Permethrin, Phenothrin, Etofenprox)

Pyrethroids are synthetic pyrethrin compounds. That means they are made in a laboratory and are not natural plant extracts. Common synthetic pyrethrins are allethrin, resmethrin, phenothrin, etofenprox, and permethrin. Allethrin and resmethrin are commonly used as flying insect killers, while phenothrin, etofenprox, and permethrin are used to control fleas and ticks. These may be slower in action than the natural pyrethrins, but have a longer effect.

**Mode of Action:** Pyrethroids, like pyrethrin, affect the nervous system of the insect, causing repetitive nerve firings.

**Use:** Pyrethroids are used for the control of ticks, fleas, lice, *Cheyletiella* mites, and mosquitoes. In addition to killing these parasites, they also repel them. Because permethrins last longer than natural pyrethrins, they are commonly found in premise sprays and in products intended for slower, but sustained action. Permethrins are soluble in oils, but not in water. This is used to advantage in products that use an oil carrier to enhance distribution of the pyrethroid over the animal's body and prolong its activity, e.g., once-a-month Bio Spot Defense, K9 Advantix II, and Vectra 3D. Permethrin should **NOT** be used on kittens or cats. Bio Spot-Spot On for Cats, which contains etofenprox, is labeled for use in cats.

**Safety:** Pyrethroids are less easily broken down than pyrethrin, so this makes their toxicity, though low, higher than that of pyrethrin. As with any pesticide, some animals may show a temporary sensitivity where the product is applied. A patient with pyrethroid toxicity will salivate, tremor, vomit, and may seizure. If these signs occur, consult your veterinarian immediately.

Permethrin and most other pyrethroids should **NOT** be used on kittens or cats.

## Imidacloprid (Advantage II)

Imidacloprid is in yet a different class of chemicals. The product Advantage II contains imidacloprid.

**Mode of Action:** Like most insecticides, imidacloprid interferes with the nerve conduction



**Do NOT use permethrin or amitraz on cats or kittens.**



system of insects. Imidacloprid acts by blocking the nerve receptors. It kills fleas, but does not have activity against ticks.

Use: Imidacloprid is most commonly used as a once-a-month topical insecticide on cats and dogs to kill fleas. Imidacloprid is mixed with an oil carrier and the drug collects in the hair follicles from which it is slowly released.

Safety: Imidacloprid has a wide margin of safety, but as with all other pesticides, some pets may develop sensitivity to the product.

Arylheterocycles (e.g.; Frontline)

Fipronil is the most commonly used product in this group of synthetic insecticides, such as Frontline Top Spot.

Mode of Action: Arylheterocycles block the passage of chlorine through cells in the insect's nervous system and this results in paralysis.

Use: Fipronil is most commonly used as a once-a-month topical insecticide on cats and dogs to kill fleas and ticks. Fipronil is generally mixed with an oil carrier and the drug collects in the hair follicles from which it is slowly released.

Safety: As with any pesticide, some animals may show a temporary sensitivity where the product is applied. Some animals may also develop more severe sensitivities, and if so, a veterinarian should be consulted.

Insect growth regulators & development inhibitors

Insect growth regulators (IGRs) and insect development inhibitors (IDIs) are relatively new components of flea and tick products. Insect growth regulators include methoprene (Precor), fenoxycarb, and pyriproxyfen (Nylar). Insect growth inhibitors include lufenuron and diflubenzuron. Products containing IGRs and IDIs include Program, Sentinel, Bio Spot, Advantage II, K9 Advantix II, and Frontline Plus.

Mode of Action: IGRs and IDIs differ from traditional flea product ingredients in that their main activity is against the immature forms of the flea. The IGRs mimic the juvenile growth hormone of fleas. The juvenile growth hormone is what keeps the fleas from developing into more mature forms. When the levels of juvenile growth hormone decrease, the larva form matures. The IGRs keep this development from occurring and the immature forms of the flea fail to molt and death occurs.

The IDIs inhibit the synthesis of a substance called chitin. Chitin is necessary for the formation of the hard outside skin (cuticle) of the flea. No chitin, no adult flea.

Use: Note that the IGRs and IDIs do not kill the adult fleas, so to be most effective, they should be used along with a product that does kill the adults (adulticide). If there is little risk of flea infestation, the IGRs and IDIs may be enough to prevent a flea infestation. However, if flea problems already exist, or the risk is high, it is best to also use an adulticide.

Many IGRs and IDIs are used in the environment as ingredients in foggers and sprays. They are also applied topically to cats and dogs, given orally, or by injection.

Remember, at this point there are no effective IGRs or IDIs for ticks.

Safety: Because IGRs and IDIs mimic insect hormones or alter a unique insect process (the making of chitin, which mammals do not make), they are extremely safe.

Amitraz

Amitraz is an ingredient that is used as a dip to treat [demodectic mange](#). Amitraz has also been shown to be highly effective when used as an ingredient in tick collars for dogs. It has little or no effect on fleas, so is used in control of ticks only. Do **NOT** use Amitraz on cats.

Mode of Action: Amitraz belongs to a group of drugs called formamidines and is an ingredient in Preventic Collars. Formamidines kill ticks by inhibiting their nerves.

Use: Amitraz has been proven to kill ticks. Amitraz is a lipophilic drug, meaning it distributes well over the entire skin, even in large dogs. Most ticks are killed by Amitraz prior to attachment or if they do attach, they are killed in less than 24 hours, thus preventing the transfer of Lyme disease. Tick collars containing Amitraz can be used at the same time with



many other flea and tick products such as Bio Spot-Spot On for Dogs (check the labels, or with your veterinarian, first). The concentration of Amitraz in the collars may not be high enough to kill demodectic mange. Do **NOT** use Amitraz on cats.



**Safety:** Collars containing Amitraz are very safe in dogs, if used correctly. The collar needs to be placed so you can get two fingers between the collar and the dog's neck no more, no less. If the collar is placed too tightly, irritation can occur. Be sure to cut off any excess portion of the collar so the dog (or other pets) can not chew the end of it. If ingested by a pet, contact your veterinarian.

#### Selamectin (Revolution)

**Mode of Action:** Selamectin kills parasites by blocking nerve signal transmissions. Revolution enters the bloodstream through the skin. It then stays in the bloodstream protecting against heartworm disease, passes into the gastrointestinal tract where it can kill certain intestinal parasites, and passes into the sebaceous glands and then onto the hair and skin providing protection against fleas and certain mites and ticks.

**Use:** Selamectin is a topical insecticide used for the treatment and prevention of fleas, ear mites, some internal parasites, and some types of mites and ticks; and the prevention of heartworm disease. Over 98% of fleas on the pet are killed within 36 hours of application. Once in contact with Revolution, fleas will not lay viable eggs.

**Safety:** Selamectin is safe to use on collies, breeding males and females, and pregnant and nursing females. Do not use it on kittens or puppies less than 6 weeks of age. As will all insecticides, use caution in using it on sick, weak, or underweight animals, or animals with broken or irritated skin.

#### Nitenpyram (Capstar)

Nitenpyram (Capstar) is approved in cats and dogs to kill fleas.

**Mode of Action:** Nitenpyram interferes with the nerve conduction system of insects, blocking the nerve receptors.

**Use:** Nitenpyram in Capstar, an oral flea control product, is approved for use in cats and dogs over 4 weeks of age and 2 pounds of body weight. Nitenpyram starts killing adult fleas that are on the pet within 30 minutes. The peak effect after administering the medication is about 3 hours for the dog and 4 hours for the cat. It will be very useful in certain circumstances such as prior to surgery, and after boarding, or grooming. It will also help prevent pets from bringing fleas home from shows, trials, or trips to the park. The pet could be given the pill before leaving for the park or before heading home from a distant show. Any fleas on the pet will be dead within several hours. It will not work for on-going control as the medication is out of the pet's system within 24 hours.



**Safety:** Capstar is safe for kittens and puppies 4 weeks and older and weighing 2 pounds or more.

#### Dinotefuran (Vectra)

**Mode of Action:** Dinotefuran interferes with the nerve conduction system of insects, and is effective upon contact. The insect does not need to ingest the insecticide for it to affect the insect.

**Use:** Dinotefuran is an active ingredient in Vectra for Cats, Vectra for Dogs, and Vectra 3D for dogs. It kills all stages of the flea cycle.

**Safety:** Do not use dinotefuran-containing products on debilitated, aged, medicated, pregnant or nursing animals, or animals known to be sensitive to pesticides without first consulting your veterinarian.

#### Spinosad (Comfortis, Trifexis)

Spinosad is used in dogs to kill fleas.

**Mode of Action:** Spinosad causes excitement of the insect's nervous system, which leads to muscle spasms, tremors, paralysis, and death of the insect.

**Use:** Comfortis is an oral flea control product that is approved for use in dogs 14 weeks of age and older. It kills adult fleas only.

**Safety:** Use Comfortis with caution in breeding females and dogs with epilepsy.

#### Citrus extracts

Citrus extracts are now being termed 'the all natural way' to control fleas and ticks. The best known of the citrus products generally contain d-Limonene or linalool. These are extracted from the peelings of citrus fruits. We basically have found these all natural citrus products to offer no advantage over traditional products, except perhaps in the pleasant citrus fragrance they impart to the coat.

**Mode of Action:** Citrus extracts affect the flea's nerves.

Use: d-Limonene and linalool are used in dips, sprays, and shampoos. In heavily infected flea regions, citrus extracts are probably not effective enough as an insecticide unless used in conjunction with more potent products.

Safety: Even though all natural, citrus extracts can be toxic to the pet and should be used in strict accordance to the label. Poisoned pets may salivate, stagger, and lose body heat. Some animals may have hypersensitivity and develop skin rashes, especially on delicate tissue such as the scrotum or vulva. Some citrus-extract products have been fatal to cats. Remember, 'Natural' does NOT necessarily mean 'Safe.'

Borax (borate)

Borax, in the form of sodium polyborate has become available to kill adult fleas and inhibit the development of immature forms. It is used as a carpet powder, but is more expensive and toxic than insect growth regulators and development inhibitors. The long-term toxic effects of borate are unknown.

Diocetyl sodium sulfosuccinate (docusate) and undecylenic acid

These two ingredients act by softening the waxy covering on fleas, ticks, lice, mites, and other insects, eventually affecting the internal organs and causing death of the insect.

Ingredients and Activity of Common Flea and Tick Control Products for Dogs and Cats

<b>Product</b>	<b>Active Ingredient</b>	<b>Species &amp; Minimum Age</b>	<b>Dosage &amp; Administration</b>	<b>Effects on External Parasites</b>	<b>Comments</b>
<b>For Use on Pets</b>					
<b>Advantage II for Cats</b>	Imidacloprid Pyriproxyfen	For cats 8+ weeks	Topical: Once/month	Kills adult fleas, eggs and larvae. Does not kill ticks.	Consult with veterinarian before using on sick, aged, pregnant, or nursing animals.
<b>Advantage II for Dogs</b>	Imidacloprid Pyriproxyfen	For dogs 7+ weeks	Topical: Once/month	Kills lice and adult fleas, eggs and larvae. Does not kill ticks.	Consult with veterinarian before using on sick, aged, pregnant, or nursing animals.
<b>Advantage Multi for Cats</b>	Imidacloprid Moxidectin	For cats 9+ weeks and 2+ lbs	Topical: Once/month	Kills adult fleas and ear mites. Does not kill ticks.	Prevents heartworm; treats and controls roundworms and hookworms. Consult with veterinarian before using on sick.

					aged, pregnant, or nursing animals.
<b>Advantage Multi for Dogs</b>	Imidacloprid Moxidectin	For dogs 7+ weeks and 3+ lbs Do NOT use on cats.	Topical: Once/month	Kills adult fleas. Does not kill ticks.	Prevents heartworm; treats and controls roundworms, whipworms and hookworms. Consult with veterinarian before using on sick, aged, pregnant, or nursing animals. Do NOT use on cats.
<b>K9 Advantix II</b>	Imidacloprid Permethrin Pyriproxyfen	For dogs 7+ weeks Do NOT use on cats.	Topical: Once/month	Kills flea eggs and larvae. Kills and repels fleas, ticks and mosquitoes. Repels biting flies. Kills lice.	Consult with veterinarian before using on sick, aged, pregnant, or nursing dogs. Do NOT use on cats.
<b>Bio Spot Defense Spot On Flea and Tick Control for Dogs</b>	Etofenprox Methoprene	For dogs 6 months or older	Topical: Once/month	Kills adult fleas and ticks; stops development of flea eggs. Kills and repels mosquitoes.	Consult with veterinarian before using on sick, medicated, aged, pregnant, or nursing dogs.
<b>Bio Spot Flea and Tick Spray for Cats and</b>	Pyrethrin Methoprene	For cats 12+ weeks	Topical: Once every 2 months. In infestations, may be used	Kills and repels adult fleas and ticks; kills flea eggs.	Consult with veterinarian before using on sick, medicated.

<b>Kittens</b>			weekly.		aged, pregnant, or nursing cats.
<b>Bio Spot Flea and Tick Spray for Dogs and Puppies</b>	Pyrethrin Methoprene	For dogs 12+ weeks	Topical: Once every 2 months. In infestations, may be used weekly.	Kills and repels adult fleas and ticks; kills flea eggs.	Consult with veterinarian before using on sick, medicated, aged, pregnant, or nursing dogs. Do NOT use on cats.
<b>Bio Spot-Spot On for Cats and Kittens</b>	Etofenprox Methoprene	For cats 12+ weeks	Topical: Once/month	Kills flea eggs and adult fleas and deer ticks; kills and repels mosquitoes.	Consult with veterinarian before using on sick, medicated, aged, pregnant, or nursing cats.
<b>Bio Spot-Spot On for Dogs</b>	Permethrin Methoprene	For dogs 6 months or older Do NOT use on cats.	Topical: Once/month	Kills and repels adult fleas, ticks, mosquitoes; kills flea eggs.	Consult with veterinarian before using on sick, medicated, aged, pregnant, or nursing dogs. Do NOT use on cats.
<b>Capstar</b>	Nitenpyram	For dogs and cats 4+ weeks, and 2+ lbs	Oral: As needed (can be given daily)	Kills adult fleas. Starts to work in 30 minutes; no residual activity.	Can be used with other flea products.
<b>Comfortis</b>	Spinosad	For dogs 14+ weeks	Oral: Once/month	Kills adult fleas.	Caution in breeding females and those with epilepsy.

<b>De Flea Pet and Bedding Spray</b>	Diocetyl sodium sulfosuccinate, undecylenic acid	For dogs and cats 12+ weeks	As needed	Controls fleas, ticks, and lice.	Can use on nursing animals.
<b>Frontline Plus for Cats</b>	Fipronil Methoprene	For cats 8+ weeks	Topical: Once/month	Kills adult fleas and ticks. Prevents flea eggs, larvae and pupae from maturing. Treats and controls chewing lice.	Approved for use in breeding, pregnant, or nursing animals. Consult with veterinarian before using on sick, medicated or aged animals.
<b>Frontline Plus for Dogs</b>	Fipronil Methoprene	For dogs 8+ weeks	Topical: Once/month	Kills adult fleas and ticks. Prevents flea eggs, larvae and pupae from maturing. Treats and controls chewing lice. Aids in the control of sarcoptic mange.	Approved for use in breeding, pregnant, or nursing animals. Consult with veterinarian before using on sick, medicated or aged animals.
<b>Frontline Spray for Cats and Dogs</b>	Fipronil	For dogs 8+ weeks and cats 8+ weeks	Topical spray: Once/month	Kills adult fleas, ticks, and chewing lice. Aids in control of sarcoptic mange in dogs.	Consult with veterinarian before using on sick, medicated, aged, pregnant, or nursing animals.

<b>Frontline Top Spot for Cats and Kittens</b>	Fipronil	For cats 8+ weeks	Topical: Once/month	Kills adult fleas, ticks, and chewing lice.	Approved for use in breeding, pregnant, or nursing animals. Consult with veterinarian before using on sick, medicated or aged animals.
<b>Frontline Top Spot for Dogs and Puppies</b>	Fipronil	For dogs 8+ weeks	Topical: Once/month	Kills adult fleas, ticks, and chewing lice. Aids in the control of sarcoptic mange.	Approved for use in breeding, pregnant, or nursing animals. Consult with veterinarian before using on sick, medicated or aged animals.
<b>Preventic Tick Collar</b>	Amitraz	For dogs 12+ weeks Do NOT use on cats.	Collar: Once/3 months	Kills ticks.	Consult with veterinarian before using on sick, medicated, aged, pregnant, or nursing dogs. Do NOT use on cats.
<b>Program Injectable for Cats</b>	Lufenuron (IDI)	For cats 6+ weeks	Once/6 months.	Stops the development of flea eggs. Does not kill adult fleas. Does not kill ticks.	Consult with veterinarian before using on sick, medicated, aged, pregnant, or nursing animals.

<b>Program Flavor Tabs for Dogs and Cats</b>	Lufenuron (IDI)	For dogs 4+ weeks and cats 4+ weeks	Once/month	Stops the development of flea eggs. Does not kill adult fleas. Does not kill ticks.	Consult with veterinarian before using on sick, medicated, aged, pregnant, or nursing animals.
<b>Program Suspension for Cats</b>	Lufenuron (IDI)	For cats 6+ weeks	Once/month	Stops the development of flea eggs. Does not kill adult fleas. Does not kill ticks.	Consult with veterinarian before using on sick, medicated, aged, pregnant, or nursing animals.
<b>Revolution</b>	Selamectin	For dogs 6+ weeks and cats 8+ weeks	Topical liquid: Once/month	Kills adult fleas, flea eggs, and American dog tick; treats and controls ear mites, controls sarcoptic mites (dogs).	Prevents heartworms; controls roundworms and hookworms (cats). Appears to be safe to use in pregnant or nursing dogs and cats. Use with caution on sick, medicated or underweight animals.
<b>Sentinel Flavor Tabs</b>	Lufenuron (IDI), Milbemycin Oxime	For dogs 4+ weeks, and 2+ lbs	Oral tablet: Once/month	Stops development of flea eggs and larvae. Does not kill ticks or adult fleas.	Prevents heartworms; controls roundworms, whipworms and hookworms. Safe to use in pregnant or

					nursing dogs.
<b>Trifexis</b>	Spinosad Milbemycin Oxime	For dogs 8+ weeks, and 5+ lbs	Oral tablet: Once/month	Kills adult fleas	Prevents heartworms; treats and controls hookworms, roundworms and whipworms. Use with caution in dogs with epilepsy and breeding females.
<b>Vectra for Cats and Kittens</b>	Dinotefuran	For cats 8+weeks	Topical liquid: Once/month	Kills adult fleas; controls all flea stages	Consult with veterinarian before using on sick, aged, pregnant, or nursing animals.
<b>Vectra for Dogs and Puppies</b>	Dinotefuran	For dogs 8+ weeks	Topical liquid: Once/month	Kills adult fleas; controls all flea stages	Consult with veterinarian before using on sick, aged, pregnant, or nursing animals. Do NOT use on cats.
<b>Vectra 3D</b>	Permethrin Dinotefuran	For dogs 7+ weeks Do NOT use on cats	Topical liquid: Once/month	Repels and kills fleas, ticks, mosquitos, lice, sand flies, and mites.	Consult with veterinarian before using on sick, aged, pregnant, or nursing animals. Do NOT use on cats.